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Abstract

Heavy-Water-Moderated, Organic-Cooled Lattice Investigations. Experimental Results and Comparison with Theory

by

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As part of the studies of the heavy-water-moderated, organic-cooled reactor concept, DOR, carried out at the Research Establishment Risö, a series of reactor-physics measurements on this type of core lattice has been performed in the exponential facility EXPO. The measurements included determination of material buckling, fine-structure flux distribution, neutron temperature, Westcott r-factor, and overall temperature coefficient of the material buckling.

The fuel elements used were cluster-type elements containing 19 fuel rods (12.7 mm diameter), clad in 1 mm thick aluminium tubes. As fuel both natural uranium metal and natural uranium dioxide were employed, and as coolant Diphyl (or Dowtherm A) and air were used.

The investigations included fuel elements surrounded by an aluminium pressure tube only as well as elements with an additional aluminium calandria tube.

The lattice pitch was varied in each series of measurements. This variation covered the range from 6 to 57 of the heavy-water to fuel volume ratio.

The present paper reports the results obtained so far for DOR-type lattices in the EXPO facility, including measurements on lattices in which the organic coolant was replaced by air. In addition a short description of the experimental techniques used in obtaining the results is given.

The reason for performing these measurements was to establish a basis

for checking the theoretical methods used in the design calculations of the DOR studies. In order to demonstrate the degree of agreement between measurements and theoretical methods favoured at present, calculated values corresponding to the experimental results are given. In this connection the theoretical methods used are outlined. These methods are based on the Westcott cross-section concept, the four-factor formula and the two-group model.

Finally a discussion of discrepancies between experimental and calculated results is given.